

WHAT IS CLAIMED IS:

1. A disk array device comprising:
  - a plurality of hard disk drives;
  - 5 at least one channel control section having a plurality of ports that are connectable to at least one information processing device via cables, and that receives data input/output requests from the least one information processing device to the plurality of hard disk drives;
  - at least one disk control section that is communicatably connected
  - 10 to the plurality of hard disk drives and that sends data input/output requests to the plurality of hard disk drives based on the data input/output requests to the plurality of hard disk drives that are received by the at least one channel control section; and
  - a shared memory that is accessible by the at least one channel
  - 15 control section and the at least one disk control section for reading and writing data therein,
  - wherein the shared memory stores a port control table that sets control information indicating whether the plurality of ports are permitted for use, and the at least one channel control section refers to the control
  - 20 information set in the port control table and determines whether to respond to a connection request regarding the ports received from the at least one information processing device.

2. A disk array device according to claim 1, wherein  
the control information includes the number of ports available for  
use among the plurality of ports,  
the connection request includes a primitive sequence in a link  
5 initialization processing for initializing linkage between the at least one  
information processing device and the plurality of ports,  
the at least one channel control section stores in the port control  
table the number of ports whose linkage is initialized among the plurality  
of ports as the number of ports in use, and  
10 upon receiving the primitive sequence in the link initialization  
processing, the at least one channel control section refers to the numbers  
of ports available for use and the number of ports in use stored in the port  
control table, wherein, when the number of ports in use is less than the  
number of ports available for use, the at least one channel control section  
15 sends to the at least one information processing device a primitive  
sequence in response to the primitive sequence in the link initialization  
processing; and when the number of ports in use is equal to or greater  
than the number of ports available for use, the at least one channel control  
section does not send to the at least one information processing device a  
20 primitive sequence in response to the primitive sequence in the link  
initialization processing.

3. A disk array device according to claim 1, wherein

the at least one channel control section includes a plurality of  
protocol processors that control the plurality of ports,

the control information includes the number of protocol processors  
available for use among the plurality of protocol processors,

5 the connection request includes a primitive sequence in a link  
initialization processing for initializing linkage between the at least one  
information processing device and the plurality of ports,

the at least one channel control section registers in the port control  
table specified protocol processors among the plurality of protocol  
10 processors that control ports whose linkage is initialized among the  
plurality of ports as protocol processors in use,

the channel control section stores in the port control table the  
number of the protocol processors in use, and

upon receiving the primitive sequence in the link initialization  
15 processing, the at least one channel control section refers to the port  
control table and determines whether the protocol processors that control  
the plurality of ports are the protocol processors in use,

wherein, when the protocol processors that control the ports are the  
protocol processors in use, the at least one channel control section sends to  
20 the at least one information processing device a primitive sequence in  
response to the primitive sequence in the link initialization processing;  
and

when the protocol processors that control the ports are not the  
protocol processors in use, the at least one channel control section refers to

the number of the protocol processors available for use and the number of protocol processors in use stored in the port control table, wherein, when the number of the protocol processors in use is less than the number of the protocol processors available for use, the at least one channel control

5 section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing, and when the number of the protocol processors in use is equal to or greater than the number of the protocol processors available for use, the at least one channel control section does not send to the at least one

10 information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

4. A disk array device according to claim 1, wherein

the at least one channel control section includes a plurality of port

15 groups each consisting of a set of plural ports among the plurality of ports,

the control information includes the number of port groups available for use,

the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one

20 information processing device and the plurality of ports,

the at least one channel control section registers in the port control table specified port groups among the port groups that include ports whose linkage is initialized among the plurality of ports as port groups in use,

the channel control section stores in the port control table the number of the port groups in use, and

upon receiving the primitive sequence in the link initialization processing, the at least one channel control section refers to the port control table and determines whether the port groups that include the plurality of ports are the port groups in use,

wherein, when the port groups that include the plurality of ports are the port groups in use, the at least one channel control section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and

when the port groups that include the plurality of ports are not the port groups in use, the at least one channel control section refers to the number of the port groups available for use and the number of port groups in use stored in the port control table, wherein, when the number of port groups in use is less than the number of port groups available for use, the at least one channel control section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing, and when the number of port groups in use is equal to or greater than the number of port groups available for use, the at least one channel control section does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

5. A disk array device according to claim 1, further comprising a plurality of packages each having a substrate with a circuit formed thereon for realizing the channel control section,

wherein the control information includes the number of packages  
5 available for use,

the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel control section registers in the port control  
10 table specified packages among the plurality of packages that include ports whose linkage is initialized among the plurality of ports as packages in use,

the channel control section stores in the port control table the number of the packages in use, and

15 upon receiving the primitive sequence in the link initialization processing, the at least one channel control section refers to the port control table and determines whether the packages that include the plurality of ports are the packages in use,

wherein, when the packages that include the plurality of ports are  
20 the packages in use, the at least one channel control section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing;  
and

when the packages that include the plurality of ports are not the packages in use, the at least one channel control section refers to the number of the packages available for use and the number of packages in use stored in the port control table, wherein, when the number of packages in use is less than the number of packages available for use, the at least one channel control section sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing, and when the number of packages in use is equal to or greater than the number of packages available for use, the at least one channel control section does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

6. A disk array device according to claim 1, wherein

the control information includes the number of logical paths available for use with the at least one information processing device,

the connection request includes a request to establish logical paths with the at least one information processing device,

the at least one channel control section registers in the port control table the number of logical paths that have been established as the number of logical paths in use, and

upon receiving the request to establish logical paths, the at least one channel control section refers to the number of logical paths available

for use and the number of logical paths in use stored in the port control table,

wherein, when the number of logical paths in use is less than the number of logical paths available for use, the at least one channel control  
5 section responds to the request to establish logical paths and establish the logical paths, and

when the number of logical paths in use is equal to or greater than the number of logical paths available for use, the at least one channel control section does not respond to the request to establish logical paths.

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7. A disk array device according to claim 1, wherein the control information indicates an availability of the plurality of ports,

the connection request includes a primitive sequence in a link  
15 initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel control section includes at least one channel processor that governs the overall control of the channel control section, at least one protocol processor that controls the plurality of ports,  
20 and a register that is referred to by the at least one protocol processor,

the at least one channel processor refers to the availability of the ports stored in the port control table, and sets the availability of the ports in the register, and



upon receiving the primitive sequence in the link initialization processing, the at least one protocol processor refers to the register, wherein, when the ports are permitted to be used, the at least one protocol processor sends to the at least one information processing device a  
5 primitive sequence in response to the primitive sequence in the link initialization processing; and when the ports are not permitted to be used, the at least one protocol processor does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

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8. A disk array device according to claim 1, wherein  
the at least one channel control section includes at least one channel processor that governs the overall control of the channel control section, at least one protocol processor that controls the plurality of ports,  
15 and a register that is referred to by the at least one protocol processor,  
the control information indicates an availability of the at least one protocol processor,

the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one  
20 information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the at least one protocol processor stored in the port control table, and sets the availability of the at least one protocol processor in the register, and

upon receiving the primitive sequence in the link initialization processing, the at least one protocol processor refers to the register, wherein, when the at least one protocol processor is permitted to be used, the at least one protocol processor sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and when the at least one protocol processor is not permitted to be used, the at least one protocol processor does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

9. A disk array device according to claim 1, wherein the at least one channel control section includes at least one channel processor that governs the overall control of the channel control section, at least one protocol processor that controls the plurality of ports, a register that is referred to by the at least one protocol processor, and at least one port group including sets of the plurality of ports, the control information indicates an availability of the at least one port group, the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the at least one port group stored in the port control table, and sets the availability of the at least one port group in the register, and

upon receiving the primitive sequence in the link initialization processing, the at least one protocol processor refers to the register, wherein, when the at least one port group is permitted to be used, the at least one protocol processor sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and when the at least one port group is not permitted to be used, the at least one protocol processor does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

10. A disk array device according to claim 1, wherein the at least one channel control section includes a plurality of packages each having a substrate with a circuit formed thereon for realizing the channel control section, the at least one channel control section includes at least one channel processor that governs the overall control of the channel control section, at least one protocol processor that controls the plurality of ports, and a register that is referred to by the at least one protocol processor, the control information indicates an availability of the packages,

the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports,

the at least one channel processor refers to the availability of the packages stored in the port control table, and sets the availability of the packages in the register, and

upon receiving the primitive sequence in the link initialization processing, the at least one protocol processor refers to the register, wherein, when the packages are permitted to be used, the at least one protocol processor sends to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing; and when the packages are not permitted to be used, the at least one protocol processor does not send to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing.

11. A disk array device according to claim 2, further comprising a management terminal that is communicatably connectable, wherein

the management terminal includes a user interface that notifies the at least one channel control section of a change in the number of ports available for use, and

upon receiving a request to change the number of ports available for use from the management terminal, the at least one channel control section changes the number of ports available for use stored in the port

control table, and refers to the number of ports in use stored in the port control table,

wherein, when the number of ports available for use is equal to or greater than the number of ports in use, and there are connected/not  
5 operating ports among the plurality of ports that are connected to the cables but whose linkage is not initialized, the at least one channel control section sends to the at least one information processing device a primitive sequence in the link initialization processing for the connected/not  
operating ports in a number less than a difference between the number of  
10 ports in use and the number of ports available for use, and

when the number of ports available for use is less than the number of ports in use, the at least one channel control section sends to the at least one information processing device a primitive sequence in a link disconnection processing for ports among the plurality of ports whose  
15 linkage is initialized such that the number of ports in use becomes equal to the number of ports available for use.

12. A disk array device according to claim 2, further comprising a management terminal that is communicatably connectable, wherein  
20 the management terminal includes a user interface that designates a port number of a first port among the plurality of ports whose linkage is initialized, and a second port number of a port that is connected to the cable but whose linkage is not initialized, and that notifies the at least one

channel control section of a switching request to switch the first port and the second port, and

upon receiving the switching request, the at least one channel control section sends to the information processing device a primitive sequence in a link disconnection processing for the first port whose linkage is initialized, and sends to the information processing device a primitive sequence in the initialization processing for the second port that is connected but whose linkage is not initialized.

10           13.   A disk array device according to claim 2, wherein the number of ports available for use is set in each of a plurality of time zones, and

the channel control section refers to the number of ports available for use and the number of ports in use in a time zone that includes the current time among the plurality of time zones,

15           wherein, when the number of ports available for use is equal to or greater than the number of ports in use, and there are connected/not operating ports among the plurality of ports that are connected to the cables but whose linkage is not initialized, the at least one channel control section sends to the at least one information processing device a primitive sequence in the link initialization processing for the connected/not operating ports in a number less than a difference between the number of ports in use and the number of ports available for use, and

when the number of ports available for use is less than the number of ports in use, the at least one channel control section sends to the at least one information processing device a primitive sequence in a link disconnection processing for ports among the plurality of ports whose  
5 linkage is initialized such that the number of ports in use becomes equal to the number of ports available for use.

14. A disk array device according to claim 1, further comprising a management terminal that is communicatably connectable, wherein the  
10 management terminal includes an interface that sets in the port control table the control information that is one of the number of ports available for use, the number of protocol processors available for use, the number of port groups available for use, the number of packages available for use, the number of logical paths available for use, an availability of each of a  
15 plurality of port groups, and an availability of each of a plurality of packages.

15. A disk array device according to claim 1, further comprising a management terminal that is communicatably connectable,  
20 wherein the shared memory includes a performance monitoring table that sets a measurement time interval for measuring a port usage rate of each of the plurality of ports, and a port usage rate threshold with respect to the port usage rate,

the at least one channel control section measures the port usage rates of the plurality of ports in the measurement time intervals set in the performance monitoring table, stores the port usage rates of the plurality of ports in the performance monitoring table, and informs the management terminal of any of the plurality of ports having the port usage rates exceeding the corresponding respective port usage rate thresholds.

16. A disk array device according to claim 15, wherein the management terminal includes a user face interface that designates each of the plurality of ports and each of the measurement time intervals, obtains from the performance monitoring table a port usage rate of the port designated during the measurement time interval designated, and displays the port usage rate obtained.

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17. A method for controlling a disk array device, the disk array device comprising a plurality of hard disk drives, at least one channel control section having a plurality of ports that are connectable to at least one information processing device via cables, and that receives a data input/output request from the least one information processing device to the plurality of hard disk drives, at least one disk control section that is communicatably connected to the plurality of hard disk drives and that sends a data input/output request to the plurality of hard disk drives based on the data input/output request to the plurality of hard disk drives



that is received by the at least one channel control section, and a shared memory that is accessible by the at least one channel control section and the at least one disk control section for reading and writing data therein, wherein the shared memory stores a port control table that sets control  
5 information indicating whether the plurality of ports are permitted for use, the method comprising the steps conducted by the at least one channel control section:

referring to the control information set in the port control table; and  
determining whether to respond to a connection request regarding  
10 the ports received from the at least one information processing device.

18. A method for controlling a disk array device according to claim 17, wherein the control information includes the number of ports available for use among the plurality of ports, and the connection request  
15 includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports, and further comprising the steps conducted by the at least one channel control section of:

storing in the port control table the number of ports whose linkage  
20 is initialized among the plurality of ports as the number of ports in use;  
receiving the primitive sequence in the link initialization processing through the plurality of ports;

referring to the numbers of ports available for use and the number of ports in use stored in the port control table;

sending to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing when the number of ports in use is less than the number of ports available for use; and

5       not sending to the at least one information processing device a primitive sequence in response to the primitive sequence in the link initialization processing when the number of ports in use is equal to or greater than the number of ports available for use.

10       19. A method for controlling a disk array device according to claim 17, wherein the control information indicates an availability of the plurality of ports, the connection request includes a primitive sequence in a link initialization processing for initializing linkage between the at least one information processing device and the plurality of ports, and the at  
15       least one channel control section includes at least one channel processor that governs the overall control of the channel control section, at least one protocol processor that controls the plurality of ports, and a register that is referred to by the at least one protocol processor, and the method comprising the steps conducted by the at least one channel processor of:  
20       referring to the availability of the ports stored in the port control table; and

      setting the availability of the ports in the register,  
and the steps conducted by the at least one protocol processor of

receiving the primitive sequence in the link initialization  
processing;

referring to the availability of the ports sent in the register;

5 sending to the at least one information processing device a primitive  
sequence in response to the primitive sequence in the link initialization  
processing, when the ports are permitted to be used; and

not sending to the at least one information processing device a  
primitive sequence in response to the primitive sequence in the link  
initialization processing when the ports are not permitted to be used.

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20. A disk array device comprising:

a plurality of hard disk drives;

at least one channel control section having a plurality of ports that  
are connectable to at least one information processing device via fiber  
15 cables, and that receives data input/output requests from the at least one  
information processing device to the plurality of hard disk drives;

at least one disk control section that is communicatably connected  
to the plurality of hard disk drives and that sends data input/output  
requests to the plurality of hard disk drives based on the data  
20 input/output requests to the plurality of hard disk drives that are received  
by the at least one channel control section;

a shared memory that is accessible by the at least one channel  
control section and the at least one disk control section for reading and  
writing data therein;

a cache memory that is used by the at least one channel control section and the at least one disk control section to temporarily store data in association with the data input/output request; and

a management terminal that is communicatably connectable,  
5 wherein the channel control section includes  
at least one protocol processor that is communicatably connected to the plurality of ports, and controls sending and receiving data to and from the information processing device,

at least one channel processor that is communicatably connected to  
10 the at least one protocol processor, the shared memory and the cache memory, and governs the overall control of the channel control section, and

a local memory that is communicatably connected to the at least one channel processor and is accessed by the at least one channel processor to  
15 read and write data therein,

the management terminal sets in the port control table the number of ports available for use among the plurality of ports,

the at least one channel processor stores in the port control table the number of ports in use that are permitted to be used among the  
20 plurality of ports,

the at least one protocol processor inquires the at least one channel processor of an availability of the ports, when connecting the fiber cables to the ports and upon receiving a primitive sequence in a link initialization through the ports,

the at least one channel processor refers to the number of ports available for use and the number of ports in use stored in the port control table, notifies the at least one protocol processor of a permission to use the ports when the number of ports in use is less than the number of ports available for use, and notifies the at least one protocol processor of a prohibition to use the ports when the number of ports in use is equal to or greater than the number of ports available for use, and

the at least one protocol processor initializes linkages in response to the primitive sequence in the link initialization processing upon receiving a notification of the permission to use from the at least channel processor, and does not respond to the primitive sequence in the link initialization upon receiving a notification of the prohibition to use.